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2 MOTION COMPENSATION SYSTEM AND METHOD

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5 BACKGROUND OF THE INVENTION

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7 This invention relates to a structure for compensating motion on an offshore platform.
8 More particularly, but not by way of limitation, this invention relates to a structure and method to
9 compensate for motion of an offshore platform due to tidal, wave, wind and other environmental
10 factors.

11 In the exploration, drilling and production of hydrocarbons, operators search in remote
12 and exotic areas of the globe. Deep water tracts have been explored and drilled with increasing
13 frequency in recent years. Platforms set in waters of 1,000 to 2,000 feet has become common
14 place, and in some instances, wells have been drilled in water depths of 5,000 feet. Different
15 types of drilling and production platforms have been used in these deep waters. One type of
16 platform is a tension leg platform (TLP). In the TLP, a floating platform is connected to the
17 ocean floor via tendons such as steel cables, as is well understood by those of ordinary skill in the
18 art. Another type of structure used in deep water is the spar platform which generally is a floating
19 cylindrical structure that is anchored to the ocean floor with steel cable means. Other types of
20 floating platforms are known in the art. In deep water, a fixed leg type platform is generally not
21 an option due to the extreme water depths.

22 In the deep water drilling of subterranean reservoirs, drillers encounter numerous

1 operational problems. For instance, wave conditions may cause a cyclic buoyant force based on
2 the raising, lowering, heaving and pitching of the platform. Also, tidal conditions may cause a
3 variation in platform height and cause similar buoyant forces. The applied forces will in turn
4 cause motion on the platform and on the work deck of the platform. Additionally, the
5 subterranean well that is drilled will have a riser extending from the sea floor to the platform. In
6 other words, a riser extends from the sea floor to the floating platform. As will be understood by
7 those of ordinary skill in the art, the riser generally does not move in unison with the platform
8 since the riser is fixed to the sea floor by different attachment means and the riser does not
9 experience the same buoyant forces as the floating platform.

10 While an operator is in the midst of performing well work, the motion of the platform can
11 have detrimental effects on the equipment and ongoing operations. For example, a coiled tubing
12 unit that is rigged-up and running a string of tools into the well could be lifted upward and/or
13 downward due to the motion of the platform. This motion could potentially cause serious
14 damage such as breaking the connection of the coiled tubing to the riser which in turn could lead
15 to a catastrophic failure. With prior art designs, operators find it necessary to stop operations and
16 rig down the connection and then reconfigure. Thus, there is a need for a system and method that
17 can compensate for motion of a floating platform while undergoing well intervention procedures.
18 This need, and many other needs, will be fulfilled according to the teachings of the present
19 invention.

SUMMARY OF THE INVENTION

A system for providing motion compensation of a platform attached to an ocean floor is disclosed. The platform is operatively associated with a riser extending from a subterranean well. The system comprises a frame member positioned on the platform and a deck slidably attached to the frame member, and wherein the deck is attached to the riser. The system further comprises means for moving the frame member relative to the deck.

In one of the preferred embodiments, the frame member contains a plurality of guide post and wherein the deck is slidably mounted on the guide post so that the frame member is movable relative to the deck.

Also in one of the preferred embodiments, the moving means comprises a cylinder member operatively attached to the frame member and a piston operatively attached to the deck and wherein the system further comprises energizing means for energizing the cylinder member so that the cylinder member extends from the piston thereby moving the frame member.

In a preferred embodiment, the energizing means comprises a pressurized (recharging) vessel configured to direct a pneumatic supply to the cylinder member and, valve panel for regulating the pressure delivered to the cylinder member. The energizing means may include a gas delivery mechanism for keeping the cylinder member within a predetermined pressure range and wherein a pressure circuit connects the gas delivery mechanism to the cylinder member. The moving means may further comprise a second cylinder member, and a second piston operatively associated with the second cylinder member.

The system may further comprise a track stacker member that is attached to the deck, and

1 an injection head operatively attached to the track stacker member and wherein the frame member
2 is positioned on the floating platform. In one of the embodiments, a coiled tubing is disposed
3 within the injection head, and wherein the coiled tubing extends into the well.

4 The frame member may further comprise a spacer and wherein the spacer is attached to a
5 floating platform in an ocean. In this way, various spacer sections may be included in order to
6 obtain the desired working height from the floating platform.

7 Also, the system may further contain a means for locking the deck to the frame in order to
8 prevent movement of the deck. In one preferred embodiment, the locking means is a pneumatic
9 cylinder with engaging pin for engaging with a latching beam attached to the frame.

10 A method of compensating for movement on an offshore platform during well operations
11 is also disclosed. The method comprises providing a motion compensator on the offshore
12 platform. The motion compensator comprises a frame member attached to the platform, and a
13 deck slidably mounted on the frame member. The method further comprises attaching the deck to
14 a riser that extends from the well to the platform, moving the offshore platform in a first vertical
15 direction, and then sliding the frame member relative to the deck.

16 In one embodiment, the motion compensator further comprises a cylinder connected to the
17 frame member, with the cylinder having a piston disposed partially therein. The piston is attached
18 to the deck and wherein the cylinder is responsive to a pressure. The step of sliding the frame
19 member comprises controlling the pressure into the cylinder with an energizing pressure means to
20 the cylinder and absorbing any force associated with the movement of the offshore platform.

21 In one of the preferred embodiments, an injector head is attached to the deck and wherein
22 the injector head receives a coiled tubing, and the method further comprises lowering the coiled

1 tubing into the riser and performing well work on the well with the coiled tubing.

2 In one of the preferred embodiments, the pressure within the cylinder is set a
3 predetermined balanced pressure and the step of controlling the pressure into the cylinder with an
4 energizing pressure means includes moving the cylinder in a downward direction in response to
5 sea movement, increasing the area within the cylinder which in turn decreases the pressure within
6 the cylinder. A gas is directed into the cylinder so that the pressure within the cylinder increases
7 until the predetermined balanced pressure is reached.

8 In the event the cylinder moves in an upward direction in response to sea movement so
9 that the area is decreased within the cylinder, pressure would be increased within the cylinder.
10 Hence, gas would be directed from the cylinder so that the pressure within the cylinder decreases,
11 and ultimately, the pressure is decreased to the predetermined balanced pressure.

12 An advantage of the present invention is that the system and method can be used on
13 floating platforms. Another advantage is that the system and method provides for motion
14 compensation on a well undergoing well intervention and remedial well work. Still yet another
15 advantage is that the present invention allows for performing coiled tubing well work safely.

16 A feature of the present invention includes the modular design of the components. The
17 modularity allows for ease of transportation, delivery and rig up. Yet another feature includes the
18 ability to build the height needed on specific well applications by simply stacking spacers one on
19 top of the other.

20 Another feature is that motion compensation is provided in the vertical direction. Yet
21 another feature is the pressure control means that regulates the pressure to the cylinders. Still
22 another feature is the use of the plurality of posts that guide the frame structure with respect to

1 the deck during movement of the platform.

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3 **BRIEF DESCRIPTION OF THE DRAWINGS**

4 FIGURE 1A is an isometric view of the frame member of the present invention.

5 FIGURE 1B is an isometric view of the motion compensation structure that includes the
6 frame member and associated deck of the present invention shown in a first position.

7 FIGURE 1C is the motion compensation structure of FIGURE 1B wherein the frame
8 member is shown moved to a second position.

9 FIGURE 2 is an isometric view of the track stack structure that is used in conjunction
10 with the motion compensation structure of FIGURES 1B and 1C.

11 FIGURE 3A is the assembly of the motion compensation structure and track stack
12 structure shown in a first position.

13 FIGURE 3B is the assembly of the motion compensation structure and track stack
14 structure shown in a second position.

15 FIGURE 4A is a schematic illustration of the forces imposed on the floating platform.

16 FIGURE 4B is a schematic illustration of the control means of the present invention.

17 FIGURE 5A is an elevation view the motion compensation structure situated on a
18 platform.

19 FIGURE 5B is the elevation view of FIGURE 5A wherein the motion compensation
20 structure has compensated due to sea movement.

21 FIGURE 6 is a partial side view of FIGURE 1B.

22 FIGURE 7 is a partial cut away view of FIGURE 6 depicting the locking cylinder and

hook member.

FIGURE 8 is a partial cross-section taken along line 8-8 of FIGURE 6.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to Fig. 1A, an isometric view of the frame member 25 that includes the base support member 4 and the top support member 6 of the present invention shown in a first position. The support member 4 is rectangular member that has four sides namely a first beam 8, second beam 10, third beam 12 and fourth beam 14. At the corners of support member 4 are attachment plates, namely attachment plate 16, attachment plate 18, attachment plate 20 and attachment plate 22. The base support member 4, top support member 6 and associated connecting beams is referred to as the frame member 25.

Fig. 1A shows that extending from the corner of beams 8, 10 is the post 24; extending from the corner of beams 10, 12 is the post 26; extending from the corner of beams 12, 14 is the post 28; and, extending from the corner of beams 8, 14 is the post 30. The post 24 is disposed through the collar 32; the post 26 is disposed through the collar 34; the post 28 is disposed through the collar 36; and, the post 30 is disposed through the collar 38. The top support member 6 is a rectangular member that consist of a first beam 42, second beam 44, third beam 46 and fourth beam 48. The beam 42 is connected to the collar 32 and 38; the beam 44 is connected to the collars 32, 34; the beam 46 is connected to the collars 34, 36; and, beam 48 is connected to

1 the collars 36, 38 as shown. The beams are connected to the collars via conventional means such
2 as welding, nuts and bolts, pins, etc. The top support member 6 is connected to the posts via
3 conventional means such as welding, by nuts and bolts, pins, etc. Figure 1A further shows
4 latching beam 49a, 49b, 49c, 49d, and wherein the latching beams 49a, 49b, 49c, 49d have
5 openings there through, for instance opening 49e.

6 Referring now to Fig. 1B an isometric view of the motion compensator structure 2 that
7 includes the frame member 25 and associated deck 50 will now be described. It should be noted
8 that like numbers appearing in the various figures refer to like components. The motion
9 compensation structure 2 includes the deck 50 that is slidably disposed on the post 24-30. More
10 specifically, the deck 50 is rectangular with a first beam 52, second beam 54, third beam 56, and
11 fourth beam 58, and wherein at each corner is a collar that will have disposed there through the
12 respective post. Hence, the collar 59a has post 24 there through; collar 59b has post 26 there
13 through; collar 59c has post 28 there through; and, collar 59d has post 30 there through. The
14 collars are attached to the beams via conventional means such as by welding, nuts and bolts, pins,
15 etc.

16 The attachment plate 16 has operatively attached a pressure cylinder 60 with a piston
17 disposed therein and wherein a piston stem 62 extends from the pressure cylinder 60, and wherein
18 the stem 62 is attached to the deck 50. The attachment plate 18 has operatively attached a
19 pressure cylinder 64 with a piston disposed therein and wherein a piston stem 66 extends from the
20 pressure cylinder 64 and wherein the stem 66 is attached to the deck 50. The attachment plate 20
21 has operatively attached a pressure cylinder 68 with a piston disposed therein and wherein a
22 piston stem 70 extends from the pressure cylinder 68 and wherein the stem 70 is attached to the

1 deck 50. The attachment plate 22 has operatively attached a pressure cylinder 72 with a piston
2 disposed therein and wherein a piston stem 74 extends from the pressure cylinder 72 and wherein
3 the stem 74 is attached to the deck 50. As seen in Fig. 1B, piston stem 62 is connected to the
4 attachment plate 75a of deck 50, piston stem 66 is connected to the attachment plate 75b of deck
5 50, piston stem 70 is connected to the attachment plate 75c of deck 50, and piston stem 74 is
6 connected to the attachment plate 75d of deck 50.

7 Fig. 1B further shows attachment plates 75a-75d will have operatively attached locking
8 cylinders with engagement pins. Fig. 1B shows cylinder 76b and 76c. Cylinder 76c will extend
9 the engagement pin (not shown here) that will engage the opening 49e of latching beam 49a,
10 thereby locking the deck 50 so that movement would be prevented. Hence, during maintenance
11 and other remedial activity, the deck can be locked and prevented from movement. This feature
12 will described in greater detail later in the application.

13 Fig. 1B also shows the hook members attached to deck 50, and more specifically the hook
14 member 77a and hook member 77b are shown. The hook members will attach to a reciprocal pin
15 member located on the cylinder. The pin members are located on the attachment plates 16, 18, 20,
16 22. By latching hooks to the pins, the deck can be prevented from movement. Hence, during
17 maintenance and other remedial activity, the deck can be locked and prevented from movement.
18 This feature will also be described in greater detail later in the application.

19 Referring now to Fig. 1C, the motion compensation structure 2 of Fig. 1B is shown and
20 wherein the frame member 25 is shown moved to a second position relative to the ocean floor, as
21 will be more fully explained later in the application. The level of deck 50 is at the same height in
22 Fig. 1B as it is in Fig. 1A. In other words, deck 50 is the same height relative to the sea floor,

1 but the frame member 25 has moved relative to the deck 50. The reason that the frame member
2 25 has moved is due to wave and/or tidal movement of the ocean wherein the frame member 25
3 has slide downward on the guide post. As seen in Fig. 1C, the piston stems 62, 66, 70 and 74 are
4 extended. The deck 50 is held in an essentially stationary position relative to the sea floor during
5 operation, as will be explained later in the application.

6 Fig. 2 is an isometric view of the track stack structure 80 that is used in conjunction with
7 the motion compensation structure 2 of Figs. 1B and 1C. The track stack structure 80 is
8 commercially available from Devin International, Inc. under the name Track Stack Jr. The track
9 stack structure 80 is in the form of a rectangular cube and consist of a first leg 82, second leg 84,
10 third leg 86, and fourth leg 88. An upper beam 90, intermediate beams 92a, 92b, and lower beam
11 94 connects the legs 82 and 84. Other members, such as diagonal members, can be added for
12 structural support. An upper beam 102, intermediate beams 104a, 104b, and lower beam 106
13 connects the pilings 84 and 86. The upper beam 108, intermediate beam 110a, and lower beam
14 110b connects the pilings 86 and 88. The upper beam 103, intermediate beams 105a, 105b and
15 lower beam 107 connects pilings 82, 88. Also, the table 111a is shown, and wherein the table
16 111a is attached to the track stack structure 80, and generally to beams 90, 102, 103, 108.

17 The table 111a has the opening 111b through which will be disposed the riser. In the most
18 preferred embodiment, the table 111a can then be attached to an injector head for coiled tubing,
19 and the injector head is attached to the riser thereby in effect attaching the deck 50 to the riser.
20 The means for attaching includes nuts and bolts, welding, pinning systems, etc, which are all very
21 well known in the art.

22 Fig. 3A is the assembly of the motion compensation structure 2 and track stack structure

1 80 shown in a first position. Fig. 3A additionally depicts a spacer structure 112, and wherein the
2 spacer structure 112 is a rectangular cube configured structure similar to the track stack structure
3 80. The spacer structure 112 is connected to the frame member 25, and more specifically, spacer
4 structure 112 is connected at the top end to the base support member 4 via conventional means
5 such as welding, nuts and bolts, pins, etc.

6 The spacer structure 112 is modular, and therefore, a number of spacer structures can be
7 stacked one on top of the other, depending on the height required. In other words, different
8 platforms, or perhaps different wells on a platform, may require different working heights. The
9 modular design allows the stacking of these spacer structures to meet the specific requirements
10 for the well intervention work, as will be understood by those skilled in the art.

11 Additionally, Fig. 3A schematically shows the pressure control means 114 for controlling
12 the pressure contained within the pressure cylinders 60, 64, 68, and 72. The pressure control
13 means 114 regulates the pressure based on a measured amount of pressure within the cylinders
14 60, 64, 68, 72. The pressure control means 114 will be discussed in greater detail in the
15 discussion of Figs. 4A and 4B.

16 Fig. 3B is the assembly of the motion compensation structure 2 and track stacker member
17 80 shown in a second position. As seen in Fig. 3B, the piston stems 62, 66, 70 and 74 are
18 extended due to the downward movement of the platform, as will be explained later in the
19 application. As noted earlier, the track stack structure 80 is attached to the deck 50 and the riser,
20 as will be more fully explained later in the application. According to the teachings of this
21 invention, the motion compensator 2 responds to ocean wave or tidal movement by way of the
22 control means 114. In the event of wave and/or tidal movement, as noted earlier, the height of

1 the frame member 25 would change. Hence, by controlling the pressure in the cylinders 60, 64,
2 68 and 72, movement of the platform can be compensated thereby reducing the tension that
3 would be applied between the track stacker structure 80 and the riser.

4 Fig. 4A is a schematic view of the forces being applied to the system herein described.
5 Hence, the floating platform 160 is being subjected to an upward buoyant force F1 by the ocean
6 while the track stacker structure 80 subjects a downward gravitational force, due to the weight of
7 structure 80, denoted by F2. In the most preferred embodiment, the deck 50 will be positioned
8 with an upward stroke of approximately three feet relative to the frame member 25 and a
9 downward stroke of approximately three feet relative to the frame member 25. The control
10 means 114, which will be described with reference to Fig. 4B, allows the operator to maintain a
11 pressure and uplift/tension balanced state between the track stack structure 80 and the frame
12 member 25 during wave and tidal movement while at the same time maintaining a three foot
13 stroke, from the mid position, in an upward or downward vertical direction. Fig. 4A also shows
14 the pad eyes E for attaching a support cable C to the structure for support during operations.

15 Fig. 4B, which is a schematic illustration, depicts the control means 114 of the present
16 invention. In the most preferred embodiment, a reservoir 116 of nitrogen or air pressure filled
17 tanks, or a similar compressed air supply, is connected to the valve panel 118, and wherein the
18 valve panel 118 regulates the amount of pressure that will be directed into the cylinders 60, 64,
19 68, 72 thereby adjusting the effective upward force and length of exposed pistons stems of the
20 main cylinders 62, 66, 70, 74. Hence, the pressure is directed from the valve panel 118 via line
21 120 to the pressure circuit which includes the pneumatic line 122, hose 124 and pressure
22 expansion vessel 126, which in turn directs the pressure to the cylinders 60, 64, 68, 72. As used

1 herein, the pressure circuit includes hose 124, vessel 126, pneumatic line 122, cylinder 68,
2 cylinder 72, cylinder 64, cylinder 60. The reservoir 116 and valve panel 118 acts to charge the
3 pressure circuit with a predetermined minimum pressure setting in order to keep the system in a
4 balanced state.

5 The vessel 126 is connected to the pneumatic line 122 via hose 124. The vessel 126 acts
6 as a reservoir to collect and transfer pressure from the pressure circuit during operation. It should
7 be noted that the pressure circuit will be set at a balanced pressure state i.e. the pressure necessary
8 to support the weight. In the most preferred embodiment, the pressure within the pressure circuit
9 will be set to allow some additional over tension/pressure so that there is an operating range of
10 pressure within the cylinders 60, 64, 68, 72.

11 In operation, the control means 114 either directs pressure to the pressure circuit
12 (including hose 124, vessel 126, line 122, cylinder 60, cylinder 64, cylinder 68, cylinder 72) or
13 directs pressure from the pressure circuit (including hose 124, vessel 126, line 122, cylinder 60,
14 cylinder 64, cylinder 68, cylinder 72) in order to maintain a predetermined upward pressure/force
15 balanced state. The change in position of the cylinders effects the pressure within the cylinders
16 which in turn dictates if pressure should be directed to the cylinders or directed from the
17 cylinders.

18 As noted earlier, the cylinders and pistons have a predetermined extension distance based
19 on a balanced pressure state. This predetermined extension distance allows a stroke distance of
20 either three feet upward or three feet downward. For example, the track stack structure 80 has
21 some specific weight without any outer forces applied thereto, and the cylinders, which are
22 attached to the floating platform, will have a predetermined buoyant force applied thereto, as was

1 shown in Fig. 4A. Referring again to Fig. 4B, the pressure circuit, and in particular cylinders 60,
2 64, 68, 72 are charged to a predetermined pressure to keep the cylinders extended in this balanced
3 state. The track stack structure 80 is attached to the sea floor via the riser 170 and wherein a
4 three foot stroke in an upward direction (see line A) and a three foot stroke in a downward
5 direction (see line B) is allowed while operating within the predetermined balanced state. In
6 effect, the pressure control means 114 acts as a shock absorber (or motion compensator) to the
7 various forces applied during the operation. It should also be noted that biasing means for biasing
8 the cylinders up and down are also possible. Examples of biasing means includes coiled springs
9 contained within the cylinders and about the pistons.

10 A gauge G measures the pressure within the system. In the case where tidal or ocean
11 movement causes the platform to lower, the cylinders would be expanded thereby increasing the
12 cylinder volume which in turn decreases the pressure within the cylinders. In order to maintain
13 the balanced state, pressure from vessel 126 would automatically be applied to the cylinders via
14 hose 124 and valve 146. This will reestablish the pressure to its balanced state, the downward
15 force applied by the track stack structure 80 is again in equilibrium with a stroke of three feet
16 minus the small drop in overall pressure and force. If pressure were not allowed to increase, the
17 frame member 25 would lower. In the practical application, the control means 114 allows the
18 ability to move upward or downward somewhat thereby decreasing the tension between the frame
19 member 25 and the deck 50 (remember, the deck 50 is in effect connected to the riser).

20 If the tidal or ocean movement causes the platform to rise, then the cylinder area is
21 decreased which in turn would cause a pressure increase. In order to maintain the balanced state,
22 pressure from the cylinders can be directed to the vessel 126 automatically via hose 124 and valve

1 146. This will reestablish the pressure to its balanced state while at the same time decreasing the
2 compressive force between the frame member 25 and the deck 50.

3 Regarding the nitrogen filled tanks 116, in one of the preferred embodiments, there are 12
4 or more nitrogen bottles positioned on a rack with a manifold. As noted earlier, the tanks 116 are
5 used to recharge the pressure circuit if the balanced pressure state falls below a predetermined
6 threshold. A gauge 128 is positioned in order to sample the pressure. A ball valve 130 is
7 positioned in the line 132, wherein the ball valve 130 controls the pressure input to the control
8 panel 118; in normal operation, the valve 130 is closed. With respect to the control panel 118, the
9 control panel 118 includes a pressure gauge 134 for reading the pressure in input line 132, a ball
10 valve 136 that will then connect to a ball valve 138 that leads to the line 120. Valve 136 is open
11 and valve 138 is opened for charging the system only. Under normal operation both valves are
12 closed in order to create a redundant sealing of the pressure in the system. A pressure gauge 140
13 is also included upstream of the ball valve 138 for system operational pressure reading. Also
14 included in one of the preferred embodiments is the relief valve 142 which may be set, for
15 instance, at 1000 psi, in order to release pressure at a predetermined set point determined by the
16 operator as exceeding a safety threshold. Fig. 4B also depicts that the control panel 118 can
17 contain the ball valve 144 for releasing pressure if found desirable by the operator; valve 144
18 would normally be closed.

19 The vessel 126 will have the ball valve 146 associated with the line 124, as well as the
20 pressure relief valve 148 that can be set at a predetermined threshold pressure of 900 psi in order
21 to relieve any build up in pressure above that amount, as will be understood by those of ordinary
22 skill in the art. In normal operations, valve 146 is open so that the pressure within the pressure

1 circuit communicates with the vessel 126.

2 Fig. 4B also depicts the hydraulic system for locking means. More specifically, a hydraulic
3 power unit 191 directs hydraulic fluid to valve 192, valve 194, valve 196, and valve 198. The
4 valve 192 directs pressure to cylinder 76a; valve 194 directs pressure to cylinder 76b; valve 196
5 directs pressure to cylinder 76c; and, valve 198 directs pressure to cylinder 76d. Once pressure is
6 supplied to the cylinders, a pin will extend therefrom and engage with the latching beams in order
7 to lock the deck relative to the frame member, as previously described. Thus, pressure supplied
8 to cylinder 76a extends pin 200; pressure supplied to cylinder 76b extends pin 202; pressure
9 supplied to cylinder 76c extends pin 204; and, pressure supplied to cylinder 76d extends pin 206.
10 Although not shown, it is possible to energize the locking means utilizing the pneumatic system,
11 rather than hydraulics; the pneumatic energizing means would use nitrogen tanks 116.

12 Fig. 5A is an elevation view of the motion compensation structure 2 positioned on a
13 tension leg type of platform 160. The tension leg platform 160 has a plurality of attachment
14 means for attaching the platform 160 to the sea floor 162. Fig. 5A depicts the steel cables 164,
15 166 that have been anchored to the sea floor 162 at a first end, and attached to the platform 160
16 at a second end. The surface of the sea is denoted at 168. It should be noted that the present
17 invention is applicable to any type of platform where height variation relative to the sea floor is a
18 factor in operations. Thus, the invention is also applicable to spar platforms, drill ships, and semi-
19 submersible rigs, etc.

20 As seen in Fig. 5A, a riser 170 extends from the sea floor 162 through the platform 160.
21 The riser 170 extends from a well 172 that is drilled to a subterranean reservoir as will be
22 understood by those of ordinary skill in the art. The riser 170 will be connected to the track stack

1 structure 80 via the table 111a. As noted earlier, the track stack structure 80 is attached to the
2 deck 50. An injector head 174 such that is used on coiled tubing installations is shown along with
3 a cat walk 176 that surrounds the top of the track stacker structure 80. The injector head 174 is
4 used to direct the coiled tubing into the well 170 as is well understood by those of ordinary skill in
5 the art.

6 Fig. 5B is an elevation view of Fig. 5A wherein the motion compensation structure 2 has
7 compensated due to sea movement. The platform 160 may be experiencing, for instance, a
8 significant wave. In Fig. 5A, note that the height of the injector head 174 relative to the sea floor
9 162 is X, while the height from the injector head 174 to the water level is Y. In Fig. 5B, the
10 platform 160 has lowered relative to the sea floor 162. Hence, the distance from the sea floor 162
11 to the injector head 174 is still X, however, the distance from the injector head 174 to the sea
12 level has increased to $Y + Z$ due to the sea and/or tidal movement. Hence, the pressure gauge G
13 (as seen in Fig. 4B) will show a decrease in pressure since the volume in the cylinders is
14 decreasing but the pressure will remain within the balanced state range due to the ability of the
15 pressure circuit to communicate with the vessel 126.

16 Note that in the case wherein the platform 160 is rising (which is seen in Fig. 5A), then the
17 area within the cylinders will decrease thereby increasing the pressure within the cylinders due to
18 the decrease in cylinder volume but the pressure will remain within the balanced state range due to
19 the ability of the pressure circuit to communicate with the vessel 126.

20 Figures 6, 7 and 8 depict the latching cylinder and hook member of the present invention.
21 The latching cylinders and hook member are means for locking the deck 50 relative to the frame
22 member 25, wherein movement is prevented. Hence, the latching cylinders represent two

1 different means for locking the deck 50 relative to the frame member 25.

2 Referring now to Fig. 6, a partial side view of Fig. 1B will now be described. The latching
3 beam 49a and 49b is shown. The pin on the cylinders will extend through openings within the
4 latching beams, and more specifically, through opening 49g and opening 49h. Fig. 6 also shows
5 the hook 77d and 77a.. According to the teachings of the present invention, if the pneumatic
6 cylinders, such as cylinder 76c, are energized, the engagement pin will extend into and engage
7 with the openings, thereby locking the deck 50 relative to the frame member 25.

8 Referring now to Fig. 7, a partial cut away view of Fig. 6 depicting the locking cylinder
9 76c and hook member 77d. This view shows that the cylinder 76c has extending therefrom the
10 locking pin 204 that is disposed through the opening 49g. The cylinder 76c is pneumatically
11 operated. In one preferred embodiment, there are four pneumatic cylinders as mentioned earlier.
12 Also, the pneumatic cylinders may all be operatively attached to the main pressure source, namely
13 nitrogen tanks 116. Alternatively, the pneumatic cylinders may have an independent pressure
14 source. While in the most preferred embodiment, pneumatic cylinders have been shown for
15 motion compensation, the cylinders may also be hydraulic or even manually controlled and
16 operated.

17 Fig. 7 also depicts the hook member 77d. The hook member 77d may be manually
18 operated. For activation, the hook member 77d is simply rotated so that the hook portion
19 (attached to the deck 50) engages a pin 182 on the cylinder 68. This prevents extension of the
20 inner rod from the cylinder 68.

21 Both latching mechanisms prevent relative movement of the deck 50 relative to the frame
22 member 25. In the course of conducting operations, it may be advantageous to prevent

1 movement, for instance during maintenance, remedial work, etc.

2 Referring to Fig. 8, a partial cross-section taken along line 8-8 of Fig. 6 will now be
3 described. The Fig. 8 shows all four hydraulic cylinders 76a, 76b, 76c, 76d attached to the
4 attachment plates 75a, 75b, 75c, 75d. Also, the latching beams 49a, 49b, 49c, 49d are shown.

5 Changes and modifications in the specifically described embodiments can be carried out
6 without departing from the scope of the invention which is intended to be limited only by the
7 scope of the appended claims and any equivalents thereof.